FEU 04 – Serial Number Restoration

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1. Scope

1.1. This procedure employs chemical reagents and specialized techniques to assist in restoring, visualizing, or revealing an obliterated serial number.

1.2. The following procedure will be used for all obliterated serial numbers to include restored, unrestored and partial restoration.

2. Background

2.1. To establish the practices for documenting the examination of firearm evidence to conform to the requirements of the Department of Forensic Sciences (DFS) Forensic Science Laboratory (FSL) *Quality Assurance Manual*, the accreditation standards under ISO/IEC 17025:2017, and any supplemental standards.

3. Safety

3.1. All Firearms Safety protocols in Appendix A will be adhered to when handling firearms.

3.2. Staff members should use universal precautions with evidentiary materials. Nitrile gloves will be utilized when performing chemical testing, including acid etching.

3.3. All chemical testing, to include mixing of chemicals, requires the use of a disposable lab coat, and eye protection.

3.4. Mixing of chemicals requires the use of a disposable lab coat, worn so that no skin is exposed between the coat sleeves and gloves, and safety goggles; additionally the use of an N95 respirator mask is recommended.

3.5. Refer to Safety Data Sheets (SDS) located in FEU Chemical Binder for instructions regarding proper storage, handling, and disposal of reagents, as well as hazards and safety precautions.

3.6. Ensure proper ventilation is available and employed. Clean up the work area upon completion of the examination and ensure that no acid has spilled around the work area. Place trash in proper receptacles. Ensure reagents are stored appropriately.

4. Materials Required

4.1. Polishing tools; sandpaper; magnifying glass; cotton swabs; magnets; magnetic particle fluid (such as MagnaFlux); digital camera; latex/nitrile gloves; safety glasses; laboratory coat; stereo microscope (magnification range 10X-20X minimum).

4.2. Use distilled water or de-ionized water in preparation of the relevant reagents; preparation instructions are found in the FEU Chemicals Binder:

- 4.2.1 Fry's Reagent
- 4.2.2 Turner's Reagent
- 4.2.3 Davis' Reagent
- 4.2.4 25% Nitric Acid
- 4.2.5 Acidic Iron (III) Chloride
- 4.2.6 Iron (III) Chloride
- 4.2.7 10% Sodium Hydroxide
- 4.2.8 Phosphoric/Nitric Acid
- 4.2.9 Additional solutions may be used for electrolytic etching and can be located in the FEU Chemical Binder.

5. Standards and Controls

5.1. Not Applicable

6. Calibration

6.1. Not Applicable

7. Procedures

7.1. Preparation of Reagents and Test Media

7.1.1. When a reagent is prepared, the following information must be recorded in the FEU Chemical Binder Preparation Log: date prepared, preparer's initials, name of reagent, lot number, and expiration date. Only analysts competent in Serial Number Restoration will prepare reagents for testing.

7.1.2. See Appendix B for solution recipes:

7.1.2.1 For ferrous alloys such as steel and stainless steels analysts may apply one of the following reagents using a cotton swab applicator:

7.1.2.1.1 Davis' Reagent

7.1.2.1.2 Turner's Reagent

7.1.2.1.3 Fry's Reagent

7.1.2.2 For non-ferrous alloys such as aluminum and zinc alloys analysts may apply one of the following reagents using a cotton swab applicator:

7.1.2.2.1 Iron (III) Chloride

7.1.2.2.2 Acidic Iron (III) Chloride

7.1.2.2.3 Phosphoric/nitric acid solution

7.1.2.2.4 25% nitric acid

7.1.2.2.5 10% Sodium Hydroxide

7.2. Item Preparation

7.2.1. Ensure all necessary firearm function and test fire examinations have been conducted prior to serial number restoration. Inventory evidence to be examined and mark the firearm in such a way as to allow for any future recognition or identification. Document the restoration examination on a LIMS Serial Number Restoration worksheet. Include a description of the evidence packaging and the condition of the seal(s) in examination notes, if applicable.

7.2.2. Throughout the examination process, photograph the evidence to show, at a minimum: the evidence as received (overall view), the area to be restored, and the final step of the restoration process.

7.2.2.1. All photographs will be annotated with, at a minimum, the following information: case number, item number, date, initials of analyst, and step of the process.

7.2.2.2. Additional annotations may be made to identify the characters restored.

7.2.3. Examine area for any partial characters that may be visible. Document the steps used and observations made during the examination to ensure full retention of information that will not be retrievable once polishing and restoring are started.

7.2.4. Polish and clean the obliterated surface area if applicable.

7.2.5. Preparation and restoration techniques chosen by the analyst, as well as the order in which they are performed, will vary according to magnetic properties, type, and severity of obliteration. If the metal is magnetic, magnetic restoration may be used to attempt to restore obliterated marks.

7.3. Magnetic Restoration

7.3.1. Place both poles of a magnet across the obliterated area and apply magnetic particle fluid over the polished surface of the obliterated marks. Vibration may be used to aid in visualization of characters, which should be photographed if possible.

7.4. Chemical Restoration

7.4.1. Reagents will be checked concurrent with each test and the results documented in the technical notes.

7.4.2. Observations of the reaction is considered as a suitable reagent control. The chemical reagent quality control check box in the Serial Number Restoration worksheet must be checked to indicate positive control.

7.4.3. If a reaction of a reagent is not observed the reagent will not be used and a new batch of reagent will be prepared.

7.4.4. Apply the appropriate chemical reagent to the metal surface using a cotton swab. The chemical reagent should be applied by swiping the cotton swab in one direction. Pause several times during this process and examine the area being processed with an appropriate magnification to determine if any results are apparent. If possible, photograph any results, since they may fade. All results must be verified in person and documented contemporaneously within LIMS.

7.4.5. After applying the appropriate chemical reagent, apply water on the area to clean off any metal that has been displaced by the reagent. The surface should then be dried with an absorbent material. Oil or lubricant may be considered for preservation of the area at the discretion of the analyst.

7.4.6. Document results of the restoration process and examination contemporaneously within LIMS. Case notes will include the reagents and equipment used and verify that reagents were tested.

7.5. Hidden and/or Barcode Serial Numbers

7.5.1. Hidden and/or barcode serial numbers may be utilized and reported, provided that the structure is consistent with a manufacturer source or

reputable federal government source, such as the ATF Serial Number Structure Guide (USDOJ) or the Firearms Reference Table database (RCMP).

7.5.1.1. Chemical and/or magnetic restoration procedures are only required when the structure of a hidden and/or barcode serial number does not match the structure provided in sources listed in 7.5.1.

7.5.1.2. The number must include all prefixes and/or suffixes to be eligible to preclude the need for chemical and/or magnetic restoration.

7.5.1.3. The number must be revealed from the frame of the firearm in order to be reported as the serial number.

7.5.1.4. The page(s) used from the sources listed in 7.5.1 must be included in the case file as supporting technical documentation.

7.5.2. Steps taken to reveal a hidden serial number may include cutting and/or removing a portion of the frame of the firearm. All steps taken to reveal a hidden and/or barcode serial number must be documented in the Serial Number Restoration worksheet.

7.5.3. Notes must distinguish between hidden serial numbers, barcode serial numbers, and hidden barcode serial numbers.

7.5.4. Revealed serial numbers must be photographed and verified by a qualified analyst. Serial numbers will be reported as “revealed/partially revealed” rather than “restored/partially restored”.

7.5.5. A Report of Examination and Test Fire worksheet will be completed and distributed to appropriate stakeholders for revealed/partially revealed serial numbers.

7.6. Range of Conclusions

7.6.1. From an examination, qualify the basis for the serial number restorations. A conclusion will reflect one of three possibilities:

7.6.1.1. Serial Number restored/revealed – the complete number and/or characters of the serial number was/is visible.

7.6.1.2. Serial Number partially restored/revealed – some of the number and/or characters of the serial number was/is visible.

7.6.1.3. Serial Number could not be restored/revealed – none of the numbers and/or characters of the serial number were/are visible.

7.6.2. The restored or partially restored serial number must be entered in the firearms data serial number field in LIMS as it is reported. If changing notes made by another analyst, the analyst updating the serial number field will indicate in the “Additional Notes” field: the previous content of the

field, the date the information was changed, and initials of the analyst who updated it.

7.7. Verification of Results

7.7.1. All serial number restorations will be verified by a qualified analyst. The results will be documented on the LIMS Serial Number Restoration worksheet.

7.7.2. There are two methods of verification:

7.7.2.1. The evidence is transferred in LIMS to the verifying analyst.

7.7.2.2. A transfer in LIMS is not required if the reporting analyst is present.

7.7.3. The reporting analyst will review the completed verification to ensure that there are no discrepancies in results and the results are documented correctly.

7.7.4. Any disagreement of results must be discussed between the reporting and verifying analysts. Both analysts must demonstrate the manner in which they reached their conclusions. Only characters that can be verified will be reported.

7.7.5. If an agreement of results is not reached, the FSL Quality Assurance specialist and FEU Management will be notified in writing and review the results and objective evidence provided by examiners. Any evidence in question will be reviewed. A third analyst may be used to independently review the results, and the final decision will be made by the FEU Management or designee.

7.7.6. All verification results will be resolved before a report can be issued.

7.8. E-Trace Documentation

7.8.1. The Test Fire worksheet will be updated with the results and sent to ATF.

8. Sampling

8.1. Not applicable

9. Calculations

9.1. Not applicable

10. Uncertainty of Measurement

10.1. Not applicable

11. Limitations

11.1. Using the chemical restoration procedure does not necessarily mean that the restored or partially restored characters will be permanently visible upon completion of the examination. The restored or partially restored characters may not be visible at some point following the chemical application. Therefore, it is recommended that the characters are photographed immediately and any characters that become visible are recorded.

12. Documentation

12.1. Serial Number Restoration worksheet

12.2. FEU-LOG-01 Chemical Prep Log

12.3. Test Fire worksheet

13. References

13.1. Bureau of Alcohol, Tobacco, Firearms and Explosives Firearm Serial Number Structure Guide, (Current Version).

13.2. Bureau of Alcohol, Tobacco, Firearms and Explosives Firearm Serial Number Restoration Training Guide, (Current Version).

13.3. FEU Chemical Binder.

13.4. Forensic Science Laboratory Quality Assurance Manual, (Current Version).

13.5. DFS Departmental Operations Manuals, (Current Versions).

13.6. FSL Laboratory Operations Manuals, (Current Versions).

13.7. FEU-LIMS-04 LIMS Guide to Serial Number Restoration (Current Version).

13.8. FEU-07 Preparation and Storage of Reagents (Current Version).

13.9. FEU-06 Report Writing and Distribution, (Current Version).

Appendix A

FIREARM SAFETY

The following protocols must be adhered to when handling any firearms:

1.1 Wear additional PPE (eye & ear protection) when discharging a firearm.

1.2 Treat every firearm as though it is loaded until you verify that it is not.

1.3 Point the muzzle in a safe direction.

1.4 Keep finger off the trigger and outside the trigger guard until ready to fire.

1.5 Always ensure target and backstop.

1.6 When in doubt about a safety issue, consult with a senior examiner or FEU Management before starting a procedure.

1.7 When transporting firearms throughout the laboratory, employ a mechanism to visually ensure that the chamber is empty and/or the action is open. Acceptable methods are zip tie, empty chamber indicator, or locking the chamber in the open position if possible. Do not transport firearms with magazines inserted.

1.8 Ensure that the barrel and chamber are clear of obstructions before firing.

1.9 When evaluating a firearm for full-auto capability, do not load more than two cartridges in the magazine, and do not fire into the water recovery tank.

1.10 When preparing to fire, do not close the action of the firearm on a live cartridge unless the muzzle is pointed downrange or placed securely in the tube of the water recovery tank.

1.11 Follow all safety instructions for the use of test firing equipment, to include the water recovery tank, firing range, remote firing devices, or any other bullet recovery method.

1.12 If a loaded or potentially loaded firearm is submitted, take it immediately to the firing range and render it safe.

1.13 Use extreme caution when inspecting/examining firearms that are damaged or in poor condition.

1.14 Utilize the remote firing device for any circumstances in which there may be a potential safety concern in discharging the firearm.

1.15 Utilize primed cases or downloaded cartridges for any circumstances in which it may be unsafe to discharge commercial cartridges (discretionary).

1.16 Do not use cell phones in the intake area, tank room, or firing range.

1.17 Do not allow live ammunition in the testing area for trigger pull weight determinations. Any examination that involves live ammunition must occur only in the designated test fire areas.

1.18 Do not allow individuals in the intake area work space, tank room, or firing range unless involved in the testing process.

1.19 Ensure that all individuals in the tank room or firing range are wearing appropriate PPE before the firearm is discharged. This includes ballistic vests for anyone not behind the Witness Protection Shield.

1.20 Anyone not involved in the test-firing process, who is in the tank room or firing range, will be behind the Witness Protection Shield during the test-fire process.

1.21 Additionally, FEU staff are encouraged, though not required, to participate in the DFS Medical Surveillance Program, for regular testing of lead levels.

1.22 All FEU personnel are required to notify another analyst (or FEU Management) in FEU prior to and after test firing is performed.

1.23 In the absence of another analyst and FEU Management, appropriate personnel (i.e. DGS, MPD) should be notified prior to and after test firing is performed.

1.24 At any time, if the firearm that is required to be test fired is potentially malfunctioning, another analyst or appropriate personnel is required to be in the room with the analyst performing the test firing.

APPENDIX B

The chemical reagents protocol and components:

1. Reagents should be made by the analyst *prior to* the solution running out.
2. 100mL batches are used per reagent.
3. Reagent bottle must be labeled with the following if stored for future use. Example of proper labeling:
    - Reagent: Davis' Reagent
    - Lot Number: 6/11/18 JBD
    - Expiration Date: 6/11/19

Reagents Components

Davis' Reagent

- 5 grams $CuCl_2$
- 50 mL conc. HCl
- 50 mL distilled water

Turner's Reagent

- 2.5 grams $CuCl_2$
- 40 mL conc. HCl
- 25 mL ethanol

Fry's Reagent

- 90 grams $CuCl_2$
- 120 mL conc. HCl
- 100 mL distilled water

25% Nitric Acid

- 25 mL conc. HNO_3
- 75 mL distilled water

10% Sodium Hydroxide

- 10 grams NaOH
- 90 mL distilled water

Iron (III) Chloride

- 25 grams $FeCl_3$
- 100 mL distilled water

Acidic Iron (III) Chloride

- 25 grams $FeCl_3$
- 25 mL conc. HCl
- 100 mL distilled water

Phosphoric/Nitric Acid solution

- 98 mL conc. H_3PO_4
- 2 mL conc. HNO_3